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DYNAMICAL MODELS OF THE MINIMAX PROGRAM MANAGEMENT OF INNOVATION PROCESSES IN ENTERPRISES WITH RISKS

Finding solutions to managing the innovation processes in an enterprise (MIPE) calls for the development of a dynamic economic and mathematical model that would take into account controllable factors, uncontrollable parameters (risks, modeling errors, etc.) and lack of information. In this case, the existing approaches to such problems are based primarily on static models and the use of stochastic modeling apparatus, which requires some expertise in the probability characteristics of the basic parameters of the model as well as the existence of some special conditions for the implementation of the process. It is worth pointing out that using the apparatus of stochastic modeling requires very strict conditions, which, in practice, are usually not attainable.

This paper proposes a determinate approach for modeling and solving the original problem in the form of the dynamic problem of a minimax program control. Aimed for optimizing the guaranteed result of the problem of MIPE at a certain point of time is based on the availability of risks for the system that its dynamics is described by a linear discrete-time recurrent vector equation. Under risks in the system of MIPE, we understand the factors that influence negatively or disastrously on the results under our consideration.

We simulate the process of MIPE on a given integer time interval $\overline{0,T} = \{0, 1, 2, ..., T\}$ by the following a linear discrete-time recurrent vector equation:

$$x(t+1) = A(t)x(t) + B(t)u(t) + C(t)v(t),\ x(0)=x_0, \tag{1}$$

where $t \in \overline{0, T-1} = \{0, 1, 2, ..., T-1\}$ ($T>0$); $x(t) \in \mathbf{R}^n$ is a phase vector of this system ($\mathbf{R}^n$ is the n-dimensional Euclidean space of column vectors, $n \in \mathbf{N}$, where **N** is a set of all natural numbers); $u(t) \in \mathbf{R}^p$ is a control vector and restricted by the given constraints

$$u(t) \in U_1 \subset \mathbf{R}^p, \tag{2}$$

and U_1 is a finite set in the space $\mathbf{R}^p$ ($p \in \mathbf{N}$); $v(t) \in \mathbf{R}^q$ is a vector of risks ($q \in \mathbf{N}$) and restricted by the given constraints

$$v(t) \in V_1 \subset \mathbf{R}^q, \tag{3}$$

and V_1 is a convex and bounded polyhedron in the space $\mathbf{R}^q$; $A(t)$, $B(t)$ and $C(t)$ are real matrixes of dimensions $(n\times n)$, $(n\times p)$ и $(n\times q)$, respectively $n, p, q \in \mathbf{N}$.

To solve the program of a minimax program control of MIPE for discrete-time dynamic system (1) – (3) with risks is suggested a methodology, which comes down to the realization of a finite number of linear and convex mathematical programming problems, and also to solving problems of discrete optimization. The proposed method makes it possible to develop efficient numerical procedures to implement a computer simulation of the dynamics of the problem under consideration and create the minimax program control of MIPE which will ensure getting a guaranteed result.

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